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Reaction rate theory of radiation exposure:Effects of dose rate on mutation frequency MASAKO BANDO, Yukawa Institute for Theoretical Physics, ISSEI NAKAMURA, Chinese Academy of Sciences, YUICHIRO MANABE, Graduate School of Engineering, Osaka University — We revisit the *linear no threshold* (LNT) hypothesis deduced from the prominent works done by H. J. Muller for the DNA mutation induced by the artificial radiation and by W. L. Russell and E. M. Kelly for that of mega-mouse experiments, developing a new kinetic reaction theory. While the existing theoretical models primarily rely on the dependence of the total dose D on the mutation frequency, the key ingredient in our theory is the *dose rate* $d(t)$ that accounts for decrease in the mutation rate during the time course of the cellular reactions. The general form for the mutation frequency with the constant dose rate d is simply expressed as, $\frac{dF_m(t)}{dt} = A - BF_m(t)$, with $A = a_0 + a_1(d + d_{eff})$ and $B = b_0 + b_1(d + d_{eff})$. We discuss the solution for a most likely case with $B > 0$; $F_m(t) = [\frac{A}{B} - F_m(0)](1 - e^{-Bt}) + F_m(0)$ with the control value $F_m(0)$. We show that all the data of mega-mouse experiments by Russel with different dose rates fall on the universal scaling function $\Phi(\tau) \equiv \frac{[F_m(\tau) - F_m(0)]}{[A/B - F_m(0)]} = 1 - \exp(-\tau)$ with scaled time $\tau = Bt$. The concept of such a scaling rule provides us with a strong tool to study different species in a unified manner.

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